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The CANMET External Planning Environment for the Period 1992-1997

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Introduction

This paper uses scenario analysis techniques to review some of the main economic, political, and social trends and events which will impact on the external planning environment of CANMET for the period 1992-97.

Scenarios can provide a useful tool for long-term strategic planning in a world characterized by uncertainty and rapid change. At the most elementary level, scenarios are simply short stories which describe how various events and trends might impact on one's particular environment. Scenarios can also serve as a filter to review various alternatives each of which demand various solutions and new approaches for CANMET.

Scenario analysis is not to be confused with making predictions or projections about the future. It is clear that no one can predict the future. Projections are usually based on traditional business forecasting and market research techniques which extrapolate on historic data in a relatively linear manner. In contrast, scenario analysis focuses on non-linear, quantum change events which tend to be the most important and least predictable (which is a redundancy).

The primary objective of scenario analysis is to alert senior management to a broad range of influences in their environment and challenge management to continuously question their assumptions about how the CANMET world is unfolding and how new events might impact on their operations.

Scenario analysis is about long-term leadership rather than day-to-day management.

Major Global Issues

A relatively limited number of major global events and trends are impacting on the external environment of CANMET. They serve to provide a broad structure and framework for a more careful and detailed consideration of the specific issues which will affect CANMET over the next five years. Some of the main global events and issues are as follows:

1. The Berlin Wall and Demilitarization
2. Trade Blocs and GATT
3. The Global Recession
4. Productivity Issues
5. Environmental Issues
6. Technology Issues
7. Commodity Price Issues

The Berlin Wall and Demilitarization

The collapse of soviet communism and the emergence of the Commonwealth of Independent States (CIS) represents one of the most significant political discontinuities of the last forty years. It is also an event with considerable potential to impact on CANMET over the next five years. The CIS is desperate for hard currencies and will do virtually anything to acquire them. Their only ready source of wealth is in the form of natural resources and it is expected that these resources will be mined and harvested as rapidly as possible over the medium term with negative impacts on world commodity prices. It is particularly important to note that the CIS natural resource base coincides extremely closely with that of CANMET's clients.

With the fall of the Berlin Wall, global demilitarization has been set on a precipitous path downwards with many projects competing for the perceived "peace dividend" as the global recession continues. As of mid-1992, we are only at the beginning of the demilitarization process in spite of the significant publicity given to military base closings in Canada, the USA, and internationally. Considering that the careers of many millions of people globally have been predicated on maintaining a defensive posture for more than fifty years, the required restructuring will meet with considerable and powerful

opposition. Agreements to further and substantially reduce missile stockpiles, conventional army size, and the like will become increasingly commonplace and the materiel required to maintain a defensive military posture will diminish demand for a wide range of natural resources.

Furthermore, it was clear to billions of TV spectators of the Gulf War that most conventional warfare techniques are essentially obsolete. Laser-guided bombs launched by radar invisible aircraft assisted by hi-tech satellite reconnaissance and electronic tracking devices represents a quantum jump from the foot soldier and tank. Global power will be increasingly wielded and determined in the UN Security Council with international sanctions and embargoes to bring warring countries and factions to heel.

With only one remaining "super-power", the rhetoric and practice of war has been fundamentally changed with global war a virtual impossibility. In such conditions, military alliances lose importance (NATO, WARSAW). These military alliances have always been closely integrated with historic economic alliances which served, in the past, to support, for example the American dollar. As these alliances weaken and disintegrate there are significant implications for global trade. For example, the possibility of the Japanese Yen becoming the world reserve currency within the next ten years is greatly strengthened.

In summary, demand for a wide range of strategic and defence related commodities, metals, materials, and energy will diminish. Demilitarization will also lead to a dramatic decline in military R&D budgets which in the past generated a broad range of technologies which were successfully commercialized in the private sector. As can be seen in the USA, there will be a significant increase in the importance of CRADAs (Cooperative R&D Agreements) with the private sector as a means to cushion these trends.

Trade Blocs and GATT

It appears that the world of the 1990s (and beyond) will be increasingly characterized by three powerful trade blocs (the Yen Bloc, the EEC, and NAFTA) with each bloc negotiate access to markets on a bilateral basis. The Latin American countries may form

an eventual fourth trading bloc with close links and possible integration with NAFTA.

The rapid formation of these trade blocs over the past few years has forced Canadian industry to undergo massive restructuring. The bad news is that this competitive, rationalizing process may still be in its early stages. Being the cheapest producer/exporter of natural resources is not, according to Michael Porter, the only or best option for Canada. Porter endorses an innovative approach characterized by value added and best practice technologies assimilated from whatever source including foreign countries.

The restructuring inspired by new competitive forces has led to several profound changes which are occurring at a rapid pace. One strong emerging trend is to move work to where people are rather than move people to the workplace. This trend has significant implication for the nature and function of cities, concentration of urban office high rises, smart building technologies, energy conservation strategies, and transportion systems. In future, it will become increasingly easy (eg competitive) to move information rather than people. Where something is done becomes less important than what is actually done.

Most businesses will increasingly farm out activities that do not offer clear advancement opportunities into senior management. This change will serve to increase productivity in the knowledge and service sectors (where productivity has been relatively stagnant). The accountability of senior management in respect of developing an international competitiveness will come under more serious review and challenge (by pension fund managers for example) in contrast to some of the self-perpetuating management practices of the past which were aided by trade protection. Japan today produces 2.5 times the quantity of manufactured goods as it did 25 years ago with the same amount of energy and with less raw material.

The trade blocs have minimized the importance of GATT. There even remains the possibility that GATT will fail to reach significant agreement, because of agricultural subsidies, with a major impact on third world countries. A retreat within trading blocs characterized by bilateral deals, will put increasing pressure on the terms of trade of primary commodity countries leading to increased production to ensure hard currency flows.

The Global Recession

A global "growth recession" accompanied by general deflation has been underway since 1989 with the end not entirely in sight. The three major economic players (USA, Germany, and Japan) are each trying to cope with the recession in different ways but the inter-relatedness of the global economy impacts on everyone. An ominous sign, according to some experts, is the historically steep "yield curve" of interest rates in North America which warns of unknown economic problems in the next five year period which will impact significantly on Canada as well. In effect, long term lenders are demanding a very high risk premium to protect against future uncertainties such as a resurgence of inflation.

This time around, however, it may be very difficult for governments to inflate their way out of debt as in the past. The national debt is not expected to change very much over the next five year planning period which is a positive statement and the deficit may come into bettter balance and perhaps begin to reduce slowly as economic growth recommences.

Core inflation rates in Canada and globally (except for certain anomalies as the CIS and Germany) have been dropping rapidly in recent years. The commodity price index has been in secular decline for most of the last 10 years and continues to achieve new lows. The Bank of Canada has established zero inflation and price stability as key goals and this policy is not expected to change in the medium term. Inflation rates in North America are expected to remain low and declining because of high unemployment rates, low consumer expectations, and excess capacity. Lower inflation rates will reduce long-term interest rates leading to a greater premium on long-term planning and related strategies.

Some experts have noted that Japan grew quickly because of their low cost of capital at about 5% while most developed countries have had to pay two or three times as much. The Japanese have historically encouraged tax incentives (since WWII) to enhance savings to create vast pools of low cost investment funds. Although the gap is narrowing, the Canadian cost of long-term capital remains too high relative to our trading partners particularly for capital intensive businesses such as those of most CANMET clients.

The Canadian exchange rate has declined by more than 5% over the past year or so in line with the average decline in many commodity prices. The Canadian dollar is still viewed by international investors as a commodity currency. Although a lower dollar appears to be a boon to exporters it also diminishes the incentive to adjust to harsh global competition. The medium term trend of the Canadian dollar may have bottomed out and, unless political uncertainty increases significantly, the dollar may once again strengthen to the 85-90 cent area. As Canadian firms increase their investment exposure abroad and become increasingly transnational, they act to minimize the impact of global currency fluctuations on profit results. Currency exchange management will continue to be a major area for management attention in the 1990s and beyond.

Productivity Issues

For the last 125 years, productivity in manufacturing, farming, mining, construction, and transport has increased at an annual rate of 3-4% compounded for a 45-fold increase in developed countries including Canada. During the 1980s this rate continued in the USA at 3.9% with a smaller improvement in Canada. During the past five years these declining rates have started to put Canada at a global competitive disadvantage although very recently some improvements are becoming evident as businesses restructure and downsize their operations.

It might be recalled that less than 30 years ago, the blue collar worker comprised 50% of the work force in North America. Today that percentage is about 20% and declining. Peter Drucker predicts that in another 15-20 years the blue collar worker will represent 5% of the labour force. The knowledge and service worker has replaced the blue collar. The main productivity gains have occurred historically in making and moving things. With the blue collar at 20%, productivity gains in this area become less significant to the total economy.

The implication for CANMET is that productivity gains may be increasingly difficult to achieve if the focus for improvement is on extraction and processing. Value added technologies will have to assume a much greater importance in the mix.

Drucker also noted that productivity increases dramatically as the number of work rules and job classifications decline. For example, the Toyota manufacturing facility in Fremont (California) has five job classifications compared to sixty in the best "Big Three" automotive plants. The Japanese plant produces 30-50% more car per worker per day. The implication is that there will have to be less focus on dollars per hour and more on total cost of work done. These trends will have significant impact on unions in the 1990s.

In knowledge and service work, partnerships with the responsible worker appear to be an important way to improve productivity, quality and performance. To stay competitive, quality control has become as important as productivity. Many Japanese manufacturing companies have adopted Zero Defects Management and Total Quality Control techniques. Statistical Quality Control is also changing the social organization of the factory in that SQC makes it possible for machine operators to be in full control of their work. SQC serves to aligne information with accountability.

Environmental Issues

Environmental issues, including the Green Paper concerns, will become more central to the long-term planning strategies of CANMET clients. For example, the decision to "decommission" more than 1000 PetroCanada service stations included a very significant budget item to remove and dispose of all potentially contaminated soil. Financing institutions, major creditors (bond holders), and pension fund managers will increasingly demand that Canadian companies provide strict guarantees, reserves, and performance bonds to ensure long term environmental compliance for eventual decommissioning. Provincial and municipal laws are also expected to change such that environmental cleanup expenses become a first mortgage or charge against any assets of natural resource companies even if the company is in receivership.

Environmental issues are generic and impact on all CANMET clients. The recent World UN Conference in Brazil on environment has set up an ambitious Plan of Action for the next decade and longer. Through increased public awareness, environmental concerns

addressed at such conferences will continue to make a substantial impact on Canada's resource sector.

Technology Issues

Globalization will grow at exponential rates during the 1990s driven by a wide range of new technologies but primarily by decreasing costs and the increasing capacity of computers and related telecommunication and video advances. The historic two year doubling speed for computing price/value is actually improving (shortening) and the standard desktop computer in year 2000 will rival the "super-computers" of 1990.

This acceleration of technological change will affect all areas of human activity. Technologies will become highly cross-functional and overlap industries rather than discrete and specific. Development project teams will include biologists, historians, economists, marketing experts, financial experts etc. CANMET clients will no longer remain competitive by relying on one technology stream but will have to mix and match from diverse areas. The implication for CANMET is a much broader exposure to international R&D activities, systematic attendance at important trade fairs, joint ventures, and a willingness to acquire technologies from abroad.

The relative importance of technology and pace of technological change remain vastly underestimated in North America. The best and most profitiable transnational companies are often devoting massive R&D resources to ensure their future leadership (often 7-8% of gross sales). On a national level South Korea is a case in point with technology being identified as the engine of growth. A South Korean recession is measured in growth rates above 5%.

Canada produces less than 2% of global technology. Systematic access to the remaining 98% is absolutely critical for Canadian small and medium sized enterprises (SMEs) to remain competitive on a global basis. Only a handful of Canadian companies perform any significant R&D and even these companies must look internationally for best practice technologies and establish strategic alliances and cross-licensing agreements on a continuous and systematic basis.

The importance of technology is not widely understood or appreciated in Canada for several reasons including branch plant mentality, traditional protective barriers etc. Domestic technology networks should be vastly improved to enhance the capability and capacity of CANMET clients, particularly SMEs, to absorb foreign technologies.

CANMET will have to consciously increase its international capacity to gather and adapt foreign technologies in cooperation with the Industrial Research Assistance Program, the Technology Inflow Program among many other Federal initiatives. Such activities will provide occasion to license and sell existing technologies in line with the CANMET goals of generating 5% of future resources from intellectual property.

Globalization thrives on inexpensive, instantaneous global communication systems, unlimited search capabilities in countless databanks and networks, and customized information flows. The concept of a "global village" becomes more important as location becomes less important. With technology and innovation being recognized as central to the long term viability of a firm (or nation), globalization is a self-strengthening trend which draws in all companies wishing to remain globally competitive and profitable. With increasing globalization, the old order of supply management, protected markets, and price agreements are under serious and persistent attack.

Commodity Price Issues

Broadly speaking, CANMET is in the commodity business and the supply of and demand for the CANMET basket of commodities impacts on the relative strength of the CANMET clientele. The Chicago Boad of Trade CRB commodity index is not comprised exclusively of CANMET commodities (agriculturals are also present) but the general global price trends are indicative in this widely traded index. Since 1980, the CRB index has declined by 60% and is still trending downwards. Today the CRB is at the same level as in 1973. In contrast, during the years of very low inflation (to which we seem to be returning) from the late fifties to the early seventies, the index remained extremely stable at 100 in contrast to the 1992 level of 200 (historic high was 325 in 1980).

A very complex set of factors impact on the general commodity price level. On the supply side the point has already been made that the CIS and Latin America are expected to become major new sources of supply in an effort to maximize their hard currency as they struggle to open their economies. There is a continuing trend to reduce and minimize consumption through recycling, energy conservation, miniaturization, improved extraction techniques, substitutability, advanced materials etc. Improved prospecting techniques have also eased supply problems.

On the demand side, global population growth is a positive factor although this growth has occurred mainly in developing countries. The major developed countries, characterized by high per capita commodity consumption, have a population distribution which is focusing more attention on increased savings rather than consumption as retirement plans have to be put in order. While this trend has the positive effect of reducing interest rates it does not directly increase demand for commodities.

Two scenario Options

There are two broad scenarios which could unfold over the next five years with the one featuring a modest to strong recovery as has been the case in previous recoveries and the other featuring a much slower recovery with frequent lapses to a recessionary level of activity. In the paper that follows, various issues are reviewed against these two scenarios.

Scenario One

1. Canada, following a USA-led recovery (80% of Canadian exports), emerges from the current long recession leaner, more competitive, and significantly restructured to generate strong and sustainable growth.

2. Canadian growth is led by strong exports with developing nations providing significant new demand for Canadian raw materials and natural resources. The commodity price index bottoms out as inflation subsides and global economic activity quickens with strong tendencies towards increased privatization and free market economics.

3. Restructuring and retraining becomes a high priority and unemployment rates gradually decline from 11% to the 8% range over the five year period.

4. Canadian industry successfully adjusts to increasingly fierce international competition including the newly structured EEC and NAFTA. Competition from most low wage countries (including Mexico) becomes less important as the wage component of most products approaches 15% of cost and as quality, design, service, innovation and marketing become relatively more important market considerations.

5. Canadian natural resources play a major role in the growth of the Canadian economy as new value-added technologies are aggressively adapted by CANMET clients and new export markets are tapped. The importance of readily adapting international technology becomes apparent. Inflation rates drop below 1% and the yield curve finally flattens with long rates declining several more points to levels of the 1960s. It becomes apparent that a premium should be placed on long-term planning strategies and CANMET plays a leading role in encouraging this mind-set.

6. The Canadian deficit finally comes into equilibrium with improved economic growth and attention can now be focused on reducing the national debt.

7. Political uncertainties fade as the various constituent demands are satisfactorily accommodated and the country is re-constituted.

Scenario Two

1. The current recession in Canada persists for most of the five year planning period with only short cycles of improved growth followed by relapses to very slow growth. Global economic conditions continue to be bearish with significant difficulties in most developed countries including the UK, Japan, Germany, Italy, and the USA.

2. The era of the 1970's and 1980's with high inflation and high interest rates comes to an end. These two decades were unique in the century. Interest rates proceed to fall back to "normal" levels of 5% long-term with considerable defationary implications. Commodity prices for most CANMET clients continue to decline as

inflation approaches zero and short interest rates become negative. The difference between the current recession and a "depression", which has no widely accepted definition, becomes difficult to describe.

3. Unemployment rates fluctuate between 10 and 15% although many people will drop out of the "active" labour force as jobs disappear and new jobs dry up. Underemployment rates rise significantly with an increase in involuntary part-time work. The rapid pace of restructuring, bankruptcies, downsizing, and closures continues.

4. Long-term interest rates gradually decline although they still remain relatively high because bond holders fear a government induced inflationary solution to the massive debt problem. The deflationary cycle feeds on itself. Consumer confidence languishes as people will not spend if they are not sure they will have a job. As leading indicators, the important housing and automobile sectors remain at relatively low levels.

5. Political uncertainty continues in Canada as the constitutional debate is not fully resolved contributing to a weaker dollar, a steeper yield curve, and low investor and consumer confidence.

6. Canadian productivity rates improve slowly, or hold their own, in line with the restructuring and downsizing relative to our most important trading partners. The NAFTA is signed and increases competition for Canadian business with an initial expansion of low wage assembly operations in Mexican "maquiladoras".

7. The former Russian republics, a number of Latin American countries, and China become major resource producers and increase the supply of natural resources as a means to earn hard currency.

1. R&D Expenditures by CANMET Client Industries

Summary of Issues

What is the correlation between R&D expenditures and the generation of commercially significant technology? Should CANMET strive to play a contra-cyclical role to assist its clients during periods of recession and intense global competition? How

can CANMET promote greater efforts in research and development and the acquisition of best practice technologies by its clients?

Factors and Considerations

A significant number of Canadian resource companies receive their new technologies from a foreign, often USA or UK, head office R&D lab. Canadian firms have been able to minimize their R&D expenditures by operating within relatively supply managed markets often protected by provincial and federal barriers to competition.

An argument could be made that CANMET should play a contra-cyclical role in relation to its clients, however, with the current tight budget conditions there will be little leeway in this area during the planning period. In future, this approach might be built into long-term planning strategies. If the government ever decides to develop and implement an industrial strategy (which is an idea gaining increased favour in the USA), the contra-cyclical role serves to stabilize growth.

The systematic identification and acquisition of best practice foreign technologies will become increasingly important to maintain global competition for CANMET clients. CANMET should be taking a leading role in this area.

Alternatives, Options and Probability

There is a good probability that the increasing pace of global competitiveness, prodded by a global downturn, will increase R&D expenditures as a percentage of GDP of most countries. To ensure that the perceived needs of business are being met, an increasing percentage of CANMET R&D will have to become demand as opposed to supply driven although there will always be room for both. CANMET will have to cost-share projects with clients to ensure that their interests are being met. Changes in Canadian fiscal policy may be essential to stimulate increased R&D expenditures including tax incentives.

Implications for CANMET

Under Scenario One, it is expected that R&D expenditures by CANMET clients would rise as the recovery continues particularly under the stimulation of greater competition from the FTA and the

NAFTA. The CIS and Latin America will generate additional global competition for CANMET clients. In spite of some signs to the contary, the EEC will close ranks in 1993 and become a more closed economy increasing pressures to deal on a bilateral basis between trading blocs. Reciprocity will have to be negotiated with best practice technologies a key ingredient and bargaining chip for strategic alliances rather than simple technology transfers. If the present recession proves to be "normal", then growth should resume in early 1993 and the five year planning period should see considerable expansion, improved productivity, new markets and much stronger inflows of investment capital once political concerns are settled and Canada re-constitutes.

Under the more negative Scenario Two alternative, R&D expenditures of CANMET clients would probably remain flat or decline because of low profit margins and adjustment to falling world prices. With rapid restructuring, R&D expenditures by firms would emphasize short term returns. This intense drive to adapt commercially viable technology will probably impact on CANMET to the extent that CANMET is needs driven.

With continued deflation in this scenario, prices decline to levels below which new exploration grinds to a halt, marginal resource properties are decommissioned (at increasing expense because of environmental concerns), new sources of investment funds diminish, and the industry served by CANMET retrenches.

Possible Reaction by CANMET

With research dollars being increasing scarce, CANMET could encourage more "effective research" in its labs and by its clients along the following recommendations offered by Peter F. Drucker in his most recent book entitled "Managing the Future: The 1990s and Beyond" (1992).

1. Every new product, processor, or service begins to become obsolete on the day that it first breaks even.

2. The only way to prevent your competition from making your product, processor or service obsolete is if you make it obsolete yourself.

3. The 19th century distinction between pure and applied research should be forgotten. Research is simply the search for new utility.

4. With effective research the various professions are tools. The project leader must know when and how to call on what specialist.

5. Effective research is three pronged involving improvement, managed evolution, and innovation. Improvement makes the already successful better still. Managed evolution uses a new product, process or service to spawn an even newer product, process or service. Innovation is the systematic use of the opportunity of change (eg demographics, technology etc.)

6. Set very high research goals in terms of performance and price because trivial changes are generally resisted as vigorously as fundamental changes.

7. Effective research requires long-term and short-term results. The balance is difficult to achieve but crucial to determine.

8. Effective research requires organized abandonment, not only of products, processes and services, but also of research projects. There are three good indicators of when to terminate a research project:

a) when there are no more significant improvements to be made;

b) when new products, processes, markets or applications no longer come out of managed evolution;

c) when long years of research produce only "interesting" results.

9. Research has to be measured and specific goals should be set for improvements and managed evolution. Every three years a full evaluation should be made of innovation results.

2. The Porter Study for Canada

Summary of Issues

Abundant natural resources have traditionally been the bedrock of the Canadian economy and will continue to be so for many years in the future. This abundance has allowed CANMET

client firms to be profitable by exporting relatively unprocessed commodities rather than concentrating on value-added activities.

Weak domestic competition has minimized the demand for advanced technology in the natural resource sector. This has in turn constrained investment in R&D and diminished demand for highly skilled employees now reflected in enrolment patterns in universities and in the nature of educational programs.

The relative absence of Canadian leading-edge related and supporting industries (clusters) has inhibited another possible source of technology growth and development. Interprovincial barriers have also served to lessen domestic demand and to decrease the degree of sector rivalry. Growing international competition and the rising strength of developing nations will become a stimulus to adapt best practice technologies in future.

Factors and Considerations

There have been significant discontinuities in the nature of international competition which include increasing globalization of trade and investment, accelerating technological changes, rapidly evolving company and country strategies. The old economic order has left a legacy of numerous policies, strategies, attitudes and mindsets that are impeding the ability of the overall economy and the natural resource sector to adjust in a positive way.

There are significant barriers to upgrading in Canadian industry that will make the move to more sophisticated competitive advantages difficult. These barriers exist in such fundamental areas as science, technology, education and training, among others. Macroeconomic policies have blunted investment opportunities while company policies and strategies often serve to reinforce these systemic internal barriers.

Many firms, insulated from external and internal rivalry, have been content to exploit the profitable domestic market. Consequently, the rate of innovation has been slow. What emerged was a tendency to administer existing wealth rather than to invest vigorously to create new wealth.

Labour/management relationships in Canada have often been counter-productive harkening back to an era of powerful unions. Porter states that ineffective government (both federal and provincial) policies must share responsibility for many of the fundamental weaknesses that persist in the economy. The policies that have most hampered competitiveness include insulation from external and internal competition, forestalling the need for upgrading, direct intervention instead of business action, programs to redistribute wealth and improve welfare that needlessly undermined the economy, and conflicting government policies and objectives.

Alternatives. Options, and Probability:

With careful resource conservation practices and a reorientation of company strategies toward leading-edge, best practice technologies, and more sophisticated products and processes, Canada's vast natural resource base will continue to be a competitive advantage globally long into the future. Natural resources alone, however, are unlikely to be a compelling advantage. Canada's future competitiveness must be driven by a new paradigm which is based solidly on productivity and innovation.

The Canadian natural resource sector and economy in general requires a new vision. This is a vision in which Canada's natural resource abundance is fully exploited, in which firms and governments focus on creating advanced skills and technology, in which domestic demand drives Canadian firms to create ever more sophisticated ways of competing, in which more Canadian firms compete globally, and in which active competition in Canada provides the key stimulus for continual upgrading.

Some of the most important imperatives that will raise productivity and improve the dynamism of the economy are the following:

a) become an innovation-driven economy;
b) increase the sophistication of the natural resource sector;
c) tackle barriers to upgrading throughout the economy;
d) build on Canada's regional strengths;
e) move quickly and decisively to achieve complete free trade within Canada:
f) transform foreign subsidiaries into home bases; and

g) create and maintain a supportive and stable macroeconomic climate.

CANMET clients firms should strive to increase investment in specialized human resource development, forge closer ties with educational institutions, and improve institutions for technology development and adoption. They should transform trade associations into factor creating mechanisms, nurture Canadian supplier industries, and establish links with Candian-based firms in related industries. Furthermore they should strive to develop and serve demanding Canadian buyers, develop labour-management relations centred on productivity, and rely more on performance-related compensation. Canadian companies should be encouraged to adopt more global strategies, define a north American or global mandate, and redefine the relationship with government.

Implications for CANMET

Client industries may not be well equipped for massive restructuring, upgrading, and adjustment necessitating a considerable awareness raising program by CANMET. The basic skill levels of many workers are inadequate and shortages exist or are looming in technology related occupations (eg engineers by year 2000 or before). The importance of continuous training, upgrading and teaching should be instilled in CANMET clients. Outreach programs may have to be intensified to ensure an adequate supply of highly trained scientists for tommorrow. CANMET should play a leadership role in effective research and innovation.

To address threats to end-markets, the emergence of low-cost competitors, and declining real commodity prices, CANMET and its client industries will have to concentrate on productivity improvements and new technologies including foreign technologies. They must develop and implement state-of-the-art production processes and develop the capability to produce products and processes based on knowledge and leading edge technology. By moving into more sophisticated products and markets, they should seek to achieve a greater degree of differentiation and broaden industry clusters.

CANMET's industries must adopt strategies of differentiation, in which unique products or superior quality command a premium

market. Reorientation of strategies from manufacturing unprocessed and semi-processed products (where competition is based primarily on cost) to a greater emphasis on value-added, more highly processed products where competition is based on knowledge. CANMET's client industries should concentrate on product lines that draw on unique Canadian strengths and from this base, move aggressively to compete and invest globally (to obtain "market feel"). They should eliminate product lines which are not internationally competitive.

Investment in specialized human resource development should be increased to ensure the skills required to meet the challenges of a rapidly changing environment. The industry (and CANMET) should learn from companies with reputations for well established, in-house training programs to determine the most cost-effective manner to invest in upgrading workforce skills. Client industries should actively seek to serve the most sophisticated and demanding buyers in their home market, as innovation and change require such competitive pressures.

Overall, Canmet should act as a facilitator to develop proactive, non-interventionist, outreach programs to assist industry become more innovative and move up the value chain. CANMET should be a provider of intelligence and deploy its intelligence networks, data bases, and in-house expertise to enhance the ability of clients to analyze and anticipate competitor trends and market developments. CANMET should act as a base of knowledge to provide the critical mass of a viable science and technology infrastructure.

3. The Federal Prosperity Initiative

Summary of Issues

The Federal Prosperity Initiative will probably emphasize technology and training as the two main pillars for future prosperity. Developing a well-educated, skilled and adaptable work force is essential for long-term Canadian prosperity. The challenge is to build a system of lifelong, continuous learning (and teaching) that provides Canadians with relevant skills to adapt to rapidly changing global conditions.

Research, innovation and technological adaptation are also recognized keys to success for companies in the global market place. The challenge is to find new approaches to improve Canada's performance in translating new scientific and technological knowledge, from wherever it may be available, into high-quality products and services for markets at internationally competitive prices.

Low cost investment capital is also required for sustained growth in productivity and living standards. The challenge is to effectively link savers and investors to provide the funding needed to finance a dynamic, growth-oriented economy. The Canadian economy must become much more investment driven which means incentives and rewards for saving. The challenge is to develop a more competitive and demanding Canadian market place so that Canadian firms can strengthen their ability to survive and compete both at home and abroad.

In response to globalization trends in industry and to the integration of domestic and international policies, the challenge is to improve access to foreign markets. Increasingly, this effort will be investment rather than export led. Without a physical presence in the market being served a company lacks the "feel" which ensures long-term competitiveness (eg witness the demise of Volkswagen in the USA). In this respect strategic alliances will play an increasingly important role in the five year planning period.

Factors and Considerations

The barriers to higher levels of research and development in Canada are complex. They include, for example, the ownership structure of the Canadian petroleum industry with many of the largest firms being subsidiaries of foreign-owned and controlled firms. This sector will naturally tend to rely more heavily on technology developed, acquired and adapted by their parent.

As world capital markets become fully integrated and barriers to trade and investment decline, investors can instantaneously shift massive amounts of capital around the globe in response to better rates or probable exchange rate adjustments. To ensure sufficient investment capital, Canada must enhance its investment climate, and maintain a tax regime in line with those of our international

competitors (the Canadian tax regime for research and development does compare favourably).

A well-focused competitiveness strategy, both domestically and internationally, will be crucial to maintain Canadian standards of living. A competitive environment fosters continuing innovation and adjustment to change. There may be requirement to consider developing an Industrial Strategy in which CANMET would play a major role. The reduction in international trade barriers puts in sharp contrast the persistence of Canada's internal barriers to trade. Interprovincial trade barriers hinder the free movement of goods and services both domestically and abroad. For example the legislative mandates of the provincial electric utilities, demand generation of all, or substantially all, of the required electricity supplies within each provincial jurisdiction.

Implications for CANMET

CANMET should encourage long_term strategic partnerships where possible and encourage the improvement of technology networks to ensure that trade, investment and technology acquisition programs are best directed to the needs and objectives of their client industries.

The policies and practices associated with public funding and private sector venture capital financing are important to the long-term establishment of strategic partnerships and the acquisition of new technologies. CANMET should be aware of the vital role of appropriate financing for its clients and participate in central agency decision making processes dealing with these specific issues.

Over the medium-term, substantial efforts will be required to improve the supply for research scientists, engineers, technologists and technicians in Canada. CANMET will have to work closely with its client industries and the educational infrastructure to ensure that the skills and knowledge of workers remain relevant to new and changing needs. CANMET should become a partner in fostering life-long learning and teaching systems in the workplace of its clients.

4. Environment and Sustainable Development Issues

Summary of Issues

Environment and sustainable development issues will become increasingly important as the current recession diminishes. For example, the emission of carbon dioxide from the combustion of carbon-based fuels is suspected of causing a global warming effect. The technological response has been to increase energy conservation and end-use efficiency including the development and use of alternative fuels. Through its refrigeration and heat-pump research program, CANMET is investigating alternatives to CFCs which have been associated with ozone depletion increasing health risks from solar radiation.

Canmet is investigating new technologies to reduce the quantities of sulphur and nitrogen oxides emitted during smelting and fuel combustion to minimize acid rain impact on forests, lakes and wild life.

Acid mine drainage may carry toxic heavy metals into the environment leading to long term ecological damage. Toxic waste disposal may be one of the most serious long term environmental issues facing the Canadian natural resource industry today and the solution has tremendous financial implications. Acid mine drainage may be treated through various chemical means, however, the operation and maintenance of chemical treatment plants, in perpetuity, is considered as unacceptable, impractical and counter to the goals of sustainable development.

The management of nuclear wastes, from mine tailings to spent reactor fuel, remains a substantial issue for the uranium and nuclear industries. In Canada, proposals for deep geological disposal of nuclear fuel wastes in the stable rock formations of the Canadian Shield are now undergoing an environmental review. For low-level radioactive wastes, an independent panel is seeking locations willing to accept a storage facility on a voluntary and participatory basis. With regard to uranium tailings, a number of mines will be decommissioned in the next few years. The Atomic Energy Control Board has established a set of strict requirements for mine decommissioning.

Sustainable development requires the careful husbanding of non-renewable resources, with greater efficiency of use, and an emphasis on recycling. For those resources which cannot be recycled (eg energy), the thrust is on maximizing the efficiency of use, and in the longer term, on developing renewable or inexhaustible alternatives.

In mineral processing, CANMET is seeking to improve the efficiency and effectiveness of resource processing, including grinding and processing circuits, and measuring and control systems. Other key aspects of future CANMET programs are focused on recovery, reduction, recycling and reuse of minerals and materials.

In alternative energy, CANMET supports the development of alternative transportation fuels, including natural gas, methanol, and electric batteries for vehicles use. Other aspects of alternative energy include improving solar air and water heaters, and developing integrated photovoltaic systems, cost-effective hybrid wind-diesel generators, improvements in small hydro systems, and improved geothermal maps and earth-energy heat pumps.

Factors and Considerations

Energy efficiency improvements, including energy conservation, can be a low-cost and effective substitution for high-cost energy supplies. Increased efficiency and conservation simultaneously address such environmental concerns as acid rain, urban air quality, and global warming. Increasing energy efficiency impacts directly on Canadian international competitiveness.

Ensuring security of supply through development of all energy forms reduces the risk of an energy price shock in the future which could substantially alter Canada's competitive terms of trade and reduce standards of living. Environmental initiatives to limit the emission of greenhouse gases may have important structural impacts on the economy through climate impact.

The implementation schedule for the 1990 Green Plan and of parallel initiatives at the provincial level will impact on CANMET's client industries and influence the technologies being developed. One of the most important linkages between trade and environmental policies arises when foreign governments limit or impose conditions on trade in certain products to achieve environmental goals for example emmission standards for power lawnmowers. Such

environmental barriers may pose a growing threat to the Canadian mineral and energy industries.

Environmental Goals of CANMET

1. To stabilize national emissions of CO2 and other greenhouse gases at 1990 levels by the year 2000 (global warming).
2. To cap acid rain-related emissions in Eastern Canada beyond 1994 through extended federal-provincial acid rain control agreements.
3. To phase out the use of CFCs by 1997, and the use of methyl chloroform and other major ozone depleting substances by year 2000.
4. To cut waste by 50% by the year 2000.
5. To strengthen the nation's environmental science and technology.

Alternatives, Options and Probability

The development of non-fossil energy sources could be a major contribution to achieving long term sustainable development. New technologies may contribute to increased energy efficiency in energy production methods, end-use efficiencies, multiple and cascaded energy use, and the development of energy efficient processes. The more rapid development and application of clean modern technology could help bring about environmental sustainable economic development.

CANMET might develop a comprehensive, scientific, technical and economic system to predict, with greater confidence, the long term management requirements for reactive tailings and waste rock. Techniques could be established that will enable the operation and closure of acid generating tailings and waste rock disposal areas in a predictable, affordable, timely and environmentally acceptable manner.

More research in transportation efficiency could accelerate the development of technologies to improve the internal combustion engine such as enhancing vehicle mechanical and electrical systems and reducing tailpipe emissions.

Alternative energy R&D could focus on the development of renewable energy technologies and standards in order to meet energy supply requirements particularly in the form of electricity. Advanced

energy systems technologies could achieve acceptance of integrated community energy planning and advanced energy systems.

CANMET may become more involved in processes to regulate the discharge of individual chemicals where the toxicological evidence already exists and promote full life-cycle management of chemicals to reduce discharges beyond regulated amounts.

Implications for CANMET

CANMET should work closely with its clients to ensure that its resources are used wisely today without jeopardizing the prosperity of future generations; this is the essence of environmental sustainability. Key aspects of this work would be to improve the efficiency with which we extract, process and use mineral and metal resources, ensuring that such aspects as recycling and conservation are an integral part of the technologies.

To ensure that the production and use of natural resources are carried out in harmony with the environment, CANMET and its client industries should develop strategies that emphasize sustainable exploration and development, sustainable extraction, sustainable processing, and sustainable handling and use.

Strategies coupled with sustainable economic policies should also ensure the continued competitiveness of the Canadian natural resource industry. CANMET should focus on and increase "no regrets" energy conservation activities and other sustainable development activities.

Under the first scenario, increasing emphasis will be given to implementing many of these measures in the short to medium term and CANMET clients should carefully budget for these downstream costs. Under the slow-growth, second scenario, environmental and sustainable development issues may receive somewhat less day-to-day importance as many companies will be struggling just to keep their heads above water and government budgets will have very little flexibility to implement new programs.

5. Viability of the Natural Resource Industries

Summary of Issue

With increasing global competition, environmental constraints to growth and development, high real interest rates, declining commodity prices, and a sluggish domestic and international economy how will CANMET's clients fare during the five-year planning period?

Factors and Considerations

There is little doubt that natural resources will continue to play a major role in Canada's economy for a very long time. International competition will, however, force CANMET clients to innovate and adapt best practice technologies (from all available sources) at a rapid pace. Foreign investment and strategic alliances will become important conduits for new technologies. More attention will be attached to value-added technologies and research as low-tech suppliers come on stream in the planning period. With many commodity prices close to cost of production and further price declines quite possible, some marginal properties will be closed. The secular decline in interest rates will be a very positive development for the industry if demand revives.

Options and Probability

Under scenario one, the probability is good that CANMET client industries will experience considerable growth during the planning period primarily because of productivity gains, interest rate improvement and a lower Canadian dollar. New demand (and supply) should increase from developing countries, the CIS, and Latin America but this demand will be met, in part, by new sources of supply near the end of the five year period. The demilitarization trend will dampen demand for some natural resource products and in some markets but will increase availability of trained scientists for private sector purposes.

Implications for CANMET

Under both scenarios, the natural resource sector will continue to play a major role in the Canadian economy over the medium term

with increasing output although as a slowly declining percentage of GNP as the service sector increases. The importance of adapting best practice technologies will become paramount and CANMET will have to facilitate the continuous acquisition of such technologies from wherever they are found. The international dimension of CANMET may have to be strengthened and integrated closely with the existing domestic networks to increase the capability of its client industries to identify and assimilate new technologies.

To ensure the long-term viability of the industry, research work at CANMET may have to follow more closely Drucker's effectiveness standards (see above) which implies a continuing client driven research program with performance standards and peer reviews to determine project life. With much lower long-term interest rates, CANMET should play a leading role in long-term strategic planning exercises with the various industry groups and emphasize the long view in its various business plans and policies.

6. The Importance of Value-Added Research Activities

Summary of Issue

Apart from a relative abundance of natural resources, Canada does not generally have a strong cost advantage in terms of labour rates, productivity levels, cost of capital, and age and efficiency of capital stock. The Canadian resource sector has generally not made the necessary investments such as upgrading process technology to increase the efficiencies in production that would yield a stronger competitive global position.

Factors and Considerations

Competitive strength based primarily on sales of raw and semi-processed natural resources is a fragile strategy in today's global environment in spite of the fact that the greatest value-added is clearly the extraction of the raw material itself. Competitive advantage in the new knowledge-intensive global economy will increasingly be based on the products of research, science and technology and this is where CANMET is clearly positioned. Research must be increasingly focused on finding new value and knowledge itself has

become the major issue. While the Canadian resource-based industries will remain of fundamental importance to the economy, their competitive health will depend on adapting best practice value-added technologies.

Options and Alternatives

CANMET will have to consider and encourage more technological investment to increase secondary processing and the development of higher value-added products. The alternative is to lose international markets. The options include new tax incentives, increased strategic partnerships, an industrial strategy for the resource sector, increased CANMET research into value-added activities.

Implications for CANMET

Canmet has an important role to play in encouraging further processing of minerals and metals in Canada and in helping industry develop higher value added metals-based products. The economic gains from value-added processing and fabrication of raw materials are substantial and will become the currency of future global competitiveness and important strategic alliances. The wage advantage of lower cost nations has diminished as wage costs approach 15% of the production cost. Mini steel mills, for example, are flourishing in the USA today. Globalization diminishes the historic importance of geographic location.

International competition from Third World suppliers will remain intense in the mining and basic metallurgical processing segments of the mineral chain, providing a compelling reason for Canada to adopt a longer term strategy to move further into semi-fabrication and fabrication activities.

Under scenario one, more profit dollars will be available to pursue value-added research activities plus global competition will become an important goad. Under scenario two of slow growth recession, most companies will be focusing of retaining existing markets, increasing productivity, and remaining viable with less attention to value-added activities.

7. The Importance and Role of Technology

Summary of Issues

Successful firms are not necessarily the discoverers and developers of the latest technologies, but they are quick to identify and assimilate important new technologies. Such companies have developed the capacity to systematically review and absorb new technologies on a continuous basis. They have developed a capability to manage new technologies and operate within long-term business plans which address marketing and financing considerations in a comprehensive manner.

The challenges that Canada's resource industries face range from mining lower-grade, deeper ores economically, to producing more valuable materials with reduced waste, to using energy reserves wisely with respect to the environment. These challenges will require the identification and assimulation of best practice technologies on a continuous basis not five or more years after competitors adapt them.

One technology strategy used in the oil and gas industry, for example, is adopt/adapt. Innovation, which tends to be mainly in process technology, but also includes new products such as new fuel and lubricants, is driven by characteristics of specific feedstock, environmental regulations, energy reduction, and regional product demands.

Discovery, development, and deployment must be integrated and viewed as concurrent rather than sequential activities. CANMET will have to constantly seek out strategic alliances and international partnerships in its highly focused investments in science and technology.

Increasing the use of information technology will be a major factor in increasing productivity, process efficiency and quality, and reducing environmental impact in mining, metal and energy operations. The future role of biotechnology in the treatment of waste from both minerals and energy production is poised for substantial increase.

Factors and Considerations:

Technology creates sweeping changes in the manner resources are used in manufacturing, in consumer tastes and values, and in the demand for and supply of resources and materials. For example, the silicon chip may soon be an interesting conversation piece in a museum, as new alloys replace it and increase computing speeds.

For example, technologies which reduce the cost of locating and developing small oil reserves will be increasingly important as will those which enhance industry's ability to economically extract oil from existing reserves.

Demand for most industrial raw materials will continue to be influenced by technological advances which tend to reduce the amount of these minerals, metals, and fuels required in manufacturing. This phenomenon is called the "dematerialization" and has had a massive impact on materials and energy to get a job done or produce a given finished product. On the supply side, the development and increasing popularity of advanced industrial materials such as polymers, ceramics and various "synthetic" materials, could result in significant displacement of the traditional base metals in a variety large-volume, end-use applications by the end of the 1990s.

Technology has become synonomous with competitiveness because it is able to increase productivity or product quality, by addressing circumstances unique to a process, company or country, and assist producers adapt to changing consumer demand. A technology-based competitiveness strategy requires a continuing commitment to the development and application of technology through research and adaptation.

Instead of innovative new technologies that could contribute to a comparative advantage, most technological advances in the industry have been incremental, stepwise improvements of existing equipment and processes, rather than major breakthroughs. Incremental advances are certainly beneficial, but they may not be sufficient in the face of strong foreign competition based substantially on non-technological factors. In such an environment, breakthrough technologies are needed. As Peter Drucker said "aim high".

Alternatives, Options and Probability

Canadian resource producers may become less competitive in the relatively low value-added segments of their industry and face increased pressure to develop technically sophisticated and better quality materials and products. CANMET could assist clients industry to become more competitive and viable by focusing more effort on product development and commercialization. CANMET could, for example, assist its client industries to capitalize on the business opportunities that are likely to develop from the move toward heightened environmental consciousness.

Implications for CANMET

As a primary concern, CANMET must raise awareness of clients of the vital importance of acquiring appropriate technologies to remain globally competitive. For example, CANMET might conduct "benchmarking" exercises to identify technology gaps (the difference between the best-practice technologies available and the technologies in current use). A research and development strategy focusing on those industry sectors with the greatest "gap" would maximize use of scarce resources.

Because of expected intense competition from foreign suppliers, CANMET might wish to attach a high priority to research on enabling technologies designed to improve the efficiency of mineral processing. The primary goal might be to assist industry in achieving steady, incremental improvements in productivity and efficiency.

Technologies should be developed to allow for the more economical recovery of valuable minerals from existing mine sites. This approach will become a higher priority as Canada's base metal reserves continue to decline in the 1990s. Enhanced recovery of by-products and of minor minerals that are increasingly in demand in a variety of new uses are also important R&D priorities for the 1990s.

Canmet could focus more attention on research designed to strengthen the technical qualities and attractiveness of traditional metal products facing increasing competition from plastics and other advanced industrial materials. It may also look at finding new uses and applications for traditional materials.

An aging scientific work force in Canada, coupled with the difficulty of recruiting young scientists and engineers, suggests that CANMET should adopt policies to increase use of secondments. Steps should be taken to attract more academic-based researchers for longer periods of time and recruitment campaigns in foreign countries might be considered.

Canada appears to be slower off the mark than its trade competitors in the acquisition and application of foreign technologies in the workplace. CANMET will have to promote the application of new technologies in the workplace in spite of a low interest in licensing or importing foreign technologies. Improving our productivity performance, and therefore, our ability to compete, is directly linked to the use of new technologies.

Under scenario one of a return to a strong economy, the increasing importance of technology as it relates to global competitiveness and improved productivity will have to assume centre stage. The Prosperity Agenda is expected to focus on traing and technology. Under scenario two of a continued recession and low growth rate, less importance will be attached to new technologies by management unles it can directly and immediately impact of productivity and profitability. Existing research by companies will have a tendency to be scaled back and it will be more difficult for CANMET to find viable shared projects to achieve its goal of 25% cost-shared activities.

8. Major Technological Trends

Summary of Issues

Scientific and technological developments will continue to produce profound social and economic changes. An important technological breakthrough in one area will frequently lead to a chain of reactions in other areas. Technological cross-functionality will become increasingly important. It will become increasingly difficult to predict major new technological trends primarily because of the pace of change. For example, the company 3M regularly plans that more than 50% of its sales will occur from products yet to be developed five years in the future.

Several areas for major development include biotechnology, advanced materials, fusion, renewable energy and generic environment, alternative transportation fuels, frontier oil and gas development and the like.

Factors and Considerations

The following USA research agenda was developed to produce strategic technologies and enhance the competitive posture of the American minerals and metals industry. Because the USA is a major market and sells to many of the same global markets, CANMET will have to study carefully and emulate many of these efforts.

Exploration: Evolutionary advances that would improve the current state of exploration techniques including improved spatial and spectral image resolution to penetrate foliage and surface cover; increased digital geophysical coverage magnetically, gravitationally, radiometrically, and spectrally to one-half mile; and improved drilling/sampling techniques and analytical methods to increase basic knowledge.

Mining technologies: The mining industry must strive to develop automated mining, processing, and extraction technologies that can be operated and maintained with the minimum exposure of people to difficult or hazardous conditions. Areas of research needed are: geosensing, nonexplosive rock fragmentation, intelligent mining systems incorporating advanced levels of cognitive ability, and in situ mining, a potentially revolutionary mining method that could greatly improve economies and allow a human-free working environment.

Minerals processing: Radical changes, bordering on revolutionary, may be in prospect for mineral processing including advances in modelling and automation with computer control of operations; in communication, through integration of blasting with crushing, through taking full advantage of pre-existing and process-created structural weaknesses, and in the use of energy other than electromechanical; and in flotation, through the development of alternative machines that exhibit higher hydraulic and process efficiencies and through advances in the application of collectorless flotation of sulfide minerals.

Metals extraction: The discovery of hydrometallurgical and biotechnological techniques for in situ extraction could greatly influence the minerals and metals industry.

Implications for CANMET

Canmet should continue to focus attention on strategic technologies including technologies to control emissions, clean up and recover useful components of present wastes, recycle materials, and destroy unusable materials with minimal environmental effects.

Under scenario one, CANMET will have to ensure that its clientele is staying competitive with the Americans and that traditional markets are maintained. Under the first scenario, greater budgets will be given to these projects and the pace of development will be rapid. CANMET may wish to encourage more strategic alliances with international institutions to share and develop many of these technologies. CANMET will have the responsibility to remain fully aware of new technologies that could impact on its clientele and, where possible, become a participant in all such significant research development projects.

Under scenario two, the pace of development will not be as rapid although the consequences of staying up with new technologies will be just as important. Companies will probably be spending most effort adjusting to rapidly changing prices, markets, and demand conditions through restructuring.

9. The Environmental Impact on Health

Summary of Issues

Because of the increasing public awareness of environmental pollution and contamination (air, water and soil), there is a strong lobby and public interest in ensuring that polluters pay and if the pollution causes general health problems (environmental sickness) that they pay much more. CANMET might have to focus more research on environment issues as they relate directly to public health and safety. A healthy environment and a strong economy must be recognized as being mutually interdependent.

During the present economic slow growth recession Canada has neither the human nor the financial resources to attack the full range of perceived health and safety problems. It should be kept in mind that health, safety and environmental technologies have a very large market and that they can also represent a viable profit centre for the private sector. The CIS is an ecological disaster area requiring massive assistance in this area.

For example, safety in underground mining would include rockburst hazards in mines and emissions from diesel-powered underground vehicles. Other issues and problems for consideration include explosion-avoidance in coal mines and ensuring the safe manufacturing and use of explosives for mining and industrial purposes. Safe transportation, including handling and disposal of minerals and metals is emerging as an important area for safety and health improvements.

Factors and Considerations:

The environmental challenge is to reduce mineral and metal wastes (particularly heavy metals) and to reduce emissions from smelting operations, in a cost effective manner. There is an increasing need to recycle and reuse industrial materials to conserve supplies and minimize environmental and long-term health risks.

Low coal prices, intense foreign competition, and increased environmental/health concerns (Green Paper targets) may continue as a cloud over the long term future of Canada's coal industry although there is little question that coal will remain an important fuel for many years to come and that fantastic progress has been made in the last decade. New technologies could change the importance of coal dramatically and impact positively on general health levels particularly in urban areas.

Options, Alternatives and Probability:

It is clear that not all of these problems can be addressed at the same time and that CANMET will have to concentrate on the most important tasks to maximize the viability of the industry and the impact on public health. Priorities should be established based on a careful assessment of risk to human health and safety, supported by credible scientific data.

In respect of urban air quality it will important to reduce the level of pollutants by encouraging use of alternative transportation fuels including natural gas, hydrogen, electricity and reformulated gasoline and diesel fuel. Increased energy efficiency and cleaner combustion technologies will also contribute significantly to improved air quality.

Water quality will be improved using technologies that minimize contamination from energy and industrial processes and which capture and treat the effluent from mines and mills. For example, Nordion International Inc. has developed new technologies for effluent treatment involving cobalt irradiation techniques to recycle raw urban wastes into fertilizer.

Preventing and minimizing soil contamination is also a very challenging task. In this respect, the development of new biotechnology methods for waste treatment show considerable promise. Improved awareness and environmental/health/safety education will continue to be a primary concern. Such education and awareness programs should strive to establish a fundamental value system.

Implications for CANMET:

CANMET should strive to ensure that all new technologies being developed, adapted, and assimilated by its clients take full account of long-term environmental, health and safety impacts. CANMET will be in the difficult position of having to balance protection of health and the environment against the need for the resource sectors to remain productive, viable, and competitive in a global (and NAFTA) setting.

Under scenario one of an early resumption of normal growth the environmental health and safety issues will become very high priority and demand a careful long-term strategy in conjunction within each industry group. Under scenario two, with a lingering recession and continued deflation, these issues will probably demand somewhat less priority in relation to restoring profits, maintaining employment levels, and finding new markets in the face of fierce global competition.

Strategic Planning: Models and Applications

During the past decade the practice of strategic planning has matured significantly and evolved in response to a wide range of pressures from inside and outside the private and public sector organizations. In very general terms, the various approaches to strategic planning might be categorized as follows:

1. The Central Control approach which accepts the view that planning is primarily a system for acquiring and allocating scarce resources.

2. The Framework for Innovation approach emphasizes planning strategies for the generation of new services, products and innovative processes leading to new markets, new clients, and new business activities.

3. The Strategic Management approach strives to formulate sound strategies which emphasize the importance of commitment, skills and talents required for implementation.

4. The Political Planning model emphasizes conflict resolution between and among interest groups both inside and outside the institution.

5. The Future Research approach is based primarily on the concept of strategic planning as exploring and creating the future, that is, accessing the range of uncertainties, developing scenarios, and working toward a strong common vision of the future.

This paper reviews a number of specific strategic models in common use in the public and private sectors. Many of the strategic planning models initially developed for the private sector have been adapted for public and nonprofit institutions to deal with their unique environments, however, not all of these private sector approaches are equally applicable to public organizations.

It attempts to identify the perceived strengths and weaknesses of these various models. Finally, it recommends for further consideration and possible adaptation within CANMET, a broad and comprehensive model developed primarily by Mr. J.M. Bryson.

Models for Strategic Planning

Within the broader approaches available for strategic planning, there are basically six strategic planning models which are considered important and widely used in the private sector including:

1. The Harvard Policy Model
2. Strategic Planning Systems
3. Stakeholder Management Approaches
4. Porfolio Models
5. Competitive Analysis models
6. Strategic Planning as a Framework for Innovation

The Harvard Policy Model

The Harvard Policy Model has evolved as part of the business policy courses taught at Harvard Business School since the early 1920s. The main purpose of this model is to help a private sector firm fit itself with its environment.

In this model, the best available strategy is determined by analyzing the internal strengths and weaknesses of the company, the values of senior management, the threats and opportunities of the external environment, and the social obligations of the firm. Effective use of this model assumes that senior management is able to adopt a common vision of the firm, agree on an appropriate strategic response, and exercise sufficient authority to enforce its decisions.

The continuous and systematic assessment of strengths, weaknesses, opportunities, and threats (called SWOT analysis) is the primary strength of the Harvard model. The main weakness of the model is that it does not include specific advice on how to develop the appropriate strategies, except to emphasize that effective strategies will build on strengths, take advantage of opportunities, and overcome or minimize weaknesses and threats.

Strategic Planning Systems

Strategic Planning Systems is characterized by managers who make, implement, and control important decisions across all functions and levels in the firm with considerable reliance of accounting and control principles. Four fundamental questions are always addressed in such a model:

1. Where are we going? (mission)
2. How do we get there? (strategies)
3. What is our blueprint for action? (budgets)
4. How do we know if we are on track? (control)

Strategic planning systems vary along three primary dimensions including the comprehensiveness of the decision areas included, the formal rationality of the decision process, and the tightness of control exercised over the implementation of the decisions.

The strength of such planning systems is their ability to coordinate and report on the various elements of a strategy across all levels and functions of the organization. The weaknesses include excessive comprehensiveness, management by prescription, which tend to minimize attention to corporate mission, long term strategies, and evolving organizational structure.

Stakeholder Management Approaches

In this model, the strategy can be understood as a corporation's mode of relating or building bridges to its stakeholders. A stakeholder is any group or individual affected by or who can affect the future of the corporation including customers, employees, suppliers, owners, governments, financial institutions, critics etc.

The strengths of the stakeholder model are its recognition and acceptance of the many claims, both complementary and competing, placed on organizations by insiders and outsiders and its awareness and understanding of the need to satisfy at least the key stakeholders if the organization is to survive. The weaknesses of the model are the absence of criteria with which to judge competing claims and the need for more advice on developing strategies to deal with divergent stakeholder interests.

The three models (the Harvard Policy Model, Strategic Planning Systems, and Stakeholder Management Approaches) presented so far focus more on process than content. These process approaches do not prescribe answers, although good answers are presumed to emerge from appropriate application of the strategies. In contrast, the two models which are discussed next, Portfolio Models and Competitive Analysis, primarily concern with content.

Portfolio Models

The idea of strategic planning as managing a portfolio of businesses is based on an analogy to investment practice. Just as an investor assembles a portfolio of stocks to manage risk and realize optimum returns, a corporate manager is able to think of the corporation as a portfolio of businesses with diverse potentials that can be balanced to achieve maximum returns within a framework of acceptable risk.

A range of Portfolio Models have been developed by the Boston Consulting Group which categorize businesses into one of four types depending on industry growth and share of the market as follows:

1.High growth/high-share businesses ("stars"), which generate substantial cash but which require large investments if their market share is to be maintained or increased.

2.low-growth/high-share businesses ("cash cows"), which generate large cash flows but require low investment and therefore generate profits that can be used elsewhere.

3.Low-growth/low-share businesses ("dogs"), which produce little cash and offer little prospect of increasd share.

4.High-growth/low-share businesses ("question marks"), which would require substantial investment to become stars or cash cows and the question is whether the investment is worth it.

The strength of the portfolio models is that they provide a ready method of measuring entities of some sort (eg. businesses, investment options, proposals, problems) against dimensions of strategic importance (eg. market share, growth, position, attractiveness). Weaknesses include the difficulty of knowing what the appropriate strategic dimensions are; the difficulty of classifying entities against

dimensions; and the lack of clarity about how to use these tools as part of a larger strategic planning process.

Competitive Analysis

Competitive Analysis assumes that by analyzing the forces that influence and shape an industry, one can predict the gerneral level for profits throughout that industry and the likely success of any particular strategic business unit. There are considered five key forces which impact on an industry as follows: the relative power of customers, the relative power of suppliers, the threat of substitute products, the threat of new entrants, and the amount of rivalrous activity among the players in the industry.

The strength of competitive analysis is that it provides a systematic way of assessing industries and the strategic options facing the strategic business unit. The weaknesses of competitive analysis (for public and non-profit organizations) are: it is often difficult to know what the "industry" is and what forces affect it, and the key to organizational success in the public world is often collaboration instead of competition.

Strategic Planning as a Framework for Innovation

While one important reason for installing a strategic planning system is the need to excercise control across functions and levels. an equally important need for organizations is to design systems that promote creativity and entrepreneuship at the local level and prevent centralization and bureaucracy from stifling the wellsprings of business growth and change.

The Framework for Innovation approach to corporate stategic planning relies on many elements of the approaches discussed above, such as SWOT analysis and portfolio methods. It differs from earlier approaches in the following manner:

1. Innovation as a basic strategy.

2. Specific management practices to support the strategy (such as project teams; venture groups; diversification acquisition, and divestment task forces; research and development operations; new

product and market groups; and a variety of organizational development techniques).

3. Development of a "vision of success" that provides the decentralized and entrepreneurial parts of the organization with a common set of goals toward which to work.

4. Nurturing of an entrepreneurial company culture.

The strength of this strategic approach is that it enhances and encourages innovation and entrepreneurship while maintaining central control. The weaknesses of the approach are that a great many, often costly, mistakes are made as part of the innovation process, and that there is inevitably a certain loss of accountability in very decentralized systems.

The models discussed to date have been developed primarily for the private sector but can be customized by specific use in the public sector. The following model, by Bryson, identifies the most important contingencies and considerations of the models discussed above for use in the public and nonprofit sector.

Strategic Planning for the Public Sector

A Public Sector Model

The following public sector model encompasses broad policy and direction setting, internal and external assessments, attention to key stakeholders, identification of key issues, development of specific strategies to deal with each issue, decision making, plan of action, and continuous monitoring of results. There are eight steps in the Bryson model as follows:

Step 1. Initiating and Agreeing on a Strategic Planning Process. The purpose of the first step is to negotiate agreement with key internal (and perhaps external) decision makers or opinion leaders about the overall strategic planning effort and the key planning steps. Their support and commitment are vital if strategic planning is to succeed.

Step 2. Clarifying Organizational Mandates

The formal and informal mandates placed on the organization are "the musts" for clarification and understanding. Public sector or-

ganizations should know as precisely as possible what they are mandated to do with targets and goals.

Step 3. Clarifying Organizational Mission and Values

The mission of a public sector organization provides its social justification and serves to eliminate a great deal of unnecessary conflict. It effectively focuses discussion and activities to maximize productivity.

Before developing a mission statement, a public sector organization should complete a comprehensive stakeholder analysis (any person, group, or organization that can place a claim on an organization's attention, resources, or output, or is affected by that output). Attention to stakeholder concerns is crucial because the key to success in public and nonprofit organization is the ultimate satisfaction of key stakeholders. Following a stakeholder analysis, a strategic planning team can develop a mission statement by answering six questions:

1. Who are we as an organization?
2. In general, what are the basic social or political needs we exist to fill, or the basic social or political problems we exist to address?
3. In general, what do we do to recognize or anticipate and respond to these needs or problems?
4. How should we respond to our key stakeholders?
5. What is our corporate philosophy and what are our core values?
6. What makes us distinctive or unique?

Step 4. Assessing the External Environment

The planning team should explore the environment outside the organization to identify any opportunities and/or threats which the organization faces (e.g. political, economic, social, technological forces and trends, and the interests of all stakeholder groups). The external assessment process should be formal and comprehensive.

Step 5. Assessing the Internal Environment

To identify internal strengths and weaknesses, the organization must carefully monitor all of its resources (inputs), present strategies (processes), and performance (outputs). Frequently, organizations do not have a clear idea of their present strategy and they make few reports on their outputs.

The absence of performance criteria and information may create problems for the organization and its stakeholders resulting in major organizational conflicts. While it is difficult to measure performance, organizations are being constantly challenged to demonstrate effective performance to stakeholders.

Step 6. Identifying the Strategic Issues Facing an Organization
The first five elements of the process lead to the sixth step which is the identification of strategic issues for the organization. It is important that strategic issues are dealt with expeditiously and effectively if the organization is to survive and prosper. All strategic issues involve conflicts of one sort of another including trade-offs.

A statement of a strategic issue contains three basic elements. The perceived issue should be described clearly and succinctly, preferably in a single paragraph; all of the factors which make the issue a fundamental policy question should be identified; finally, all of the consequences of failure to address the issue should be specified in detail. There are three basic approaches to identifying strategic issues: the direct approach, the goals approach, and the "vision of success" approach.

Step 7. Formulating Strategies to Manage the Issues.
A stragegy is defined as a pattern of purposes, policies, programs, actions, decisions, or resource allocations that define what an organization is, what it does, and why it does it. Strategies can vary by level, function, and time frame.

Strategy development begins with identification of practical alternatives, and visions or solutions for resolving the strategic issues. The barriers to achieving the solutions,alternatives, or visions must be spelled out. Proposals are then developed for achieving the solutions or visions either directly or indirectly, through overcoming the barriers. Finally the actions required over the next several years to implement the major proposals should be set out in a Plan of Action, and a detailed work program for the short term must be established to implement the actions

Step 8. Establishing an Effective Organizational Vision
In the final step of this process, the organization develops a description of what it wishes to achieve or look like as it successfully

implements its strategies and overcomes the perceived barriers. This description is a "vision of success " which should be a short written statement.

In summary, these eight steps serve to bring a certain order to the complex process of strategic thinking in a government organization and permit more stakeholders to participate in a meaningful manner. This process can be applied across all levels and functions in an organization.

(see attached graphic description of Bryson model)

References

Bryson, J. M. (1988), **Strategic Planning for Public and Non-profit Organizations.** San Francisco: Jossey - Bass.

Bryson, J. M. Freeman, R. E. Roering, W.D. (1986), **"Strategic Planning in the Public Sector: Approaches and Directions."** in Checkoway, B. (Ed.), **Strategic Perspetives on Planning Practice,** pp. 65-86. Lexinton: Lexington Books.

Chatterjee S. and Wernerfelt, B., **"The Link Between Resources and Type of Diversification: Theory and Evidence." Strategic Management, 12 (1), 1991.**

Dyson, R.G. (1990), **Strategic Planning: Models and Analytical Techniques.** Wiley.

Ensign, M. and Adler, L. N. (Eds.) (1985), **Strategic Planning: Contempory Viewpoints.** Santa Barbara, Calif. ABC -Clio Information Services.

Hanna, Nagy (1985), **Strategic Planning and Management: a Review of Recent Experiences.** World Bank, Washington D.C..

Hay, R. (1990), **Strategic Management in Non-Profit Organizations: An Admininstrator's Handbook.** Greenwood: Greenwood Press.

Huff, A.S. and Reger, R.K. **"A Review of Strategic Process Research", Journal of Management,** 13, 1987.

Ireland, R. D. Hitt, M. A. Bettis, R. A. and dePorras, D. A. **"Strategy Formulation Processes: Differences in Perceptions of Strength and Weakness Indicators and Environmental Uncertainty by Managerial Level", Strategic Management Journal,** 8, 1987.

King, W. R. and Cleland, D. I. (Eds.) (1987), **Strategic Planning and Management Handbook**. New York: Van Nostrand Reinhold Co.

Millet, S. M. and Rolf, **"The Business Information and Analysis Function: A New Approach to Strategic Thinking and Planning." Planning Review,** May/June, 1991.

Saaty, T. L. (1990), **Multi-criteria Decision Making: The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation.** RWS Pubns.

Schwen, C. R. (1988), **The Essence of Strategic Decision Making,** Lexington: Lexington Books.

Steiss, A. W. (1985), **"Strategic Planning" in Strategic Management and Organizational Desesion Making,** pp.71-76, Lexington: Lexington Books.

Strategic Planning for Cogeneration and Energy Management. (1987), Atlanta: Fairmont Press

Strategic Planning in Energy and Natural Resources. (1986), New York: Amsterdam.

Taylor, B. (1987), **"An Overview of Strategic Planning Styles"** in King, W. R. and Cleland, D. I. (Eds.), **Strategic Planning and Managemet Handbook,** pp.21-35, New York: Van Nostrand Reinhold Co.

Welsh, H. **"Cost-effective Control Strategy for Energy"**

Related Transboundary Air Pollution in Western Europe", The Energy Journal, 11 (2), 1991.